DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
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METHOD OF TEST FOR PERCENTAGE OF FLAT AND ELONGATED PARTICLES IN COARSE AGGREGATE

A. SCOPE

This test method describes the procedure for determining the percentages of flat particles, elongated particles, or flat and elongated particles in coarse aggregates using the ratios of width to thickness, length to width, or length to thickness measured from individual particles of aggregate of specific sieve sizes.

B. REFERENCES

California Test 125 - Sampling Highway Materials and Products Used in the Roadway Structural Sections
California Test 201 - Soil and Aggregate Sample Preparation
California Test 202 - Sieve Analysis of Fine and Coarse Aggregates
ASTM D 4791 - Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

C. SIGNIFICANCE AND USE

Use ASTM D 4791, Section 5.2.

D. APPARATUS

Use ASTM D 4791, Section 6.

Digital Caliper: the caliper illustrated in Figure 1 shows another suitable device for this test method.

E. TERMINOLOGY

Use ASTM D 4791, Section 3. Section 3.1.2 does not apply.

F. SAMPLING

Use ASTM D 4791, Section 7.

Use California Tests 125 and 201, respectively. References to ASTM D75 and C702 do not apply.

G. PROCEDURE

Use ASTM D 4791, Sections 8.1, 8.2, and 8.4.

Use California Tests 202 and 201 respectively. References to ASTM C136 and C702 do not apply.

H. CALCULATIONS

See example calculations.

I. REPORT

Use form attached.

J. HEALTH AND SAFETY

It is the responsibility of the user of this test method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Prior to handling, testing or disposing of any materials, testers must be knowledgeable about safe laboratory practices, hazards and exposure, chemical procurement and storage, and personal protective apparel and equipment.

Caltrans Laboratory Safety Manual is available at:

http://www.dot.ca.gov/hq/esc/ctms/pdf/lab_safety_manual.pdf

End of Text
(California Test 235 contains 3 pages)

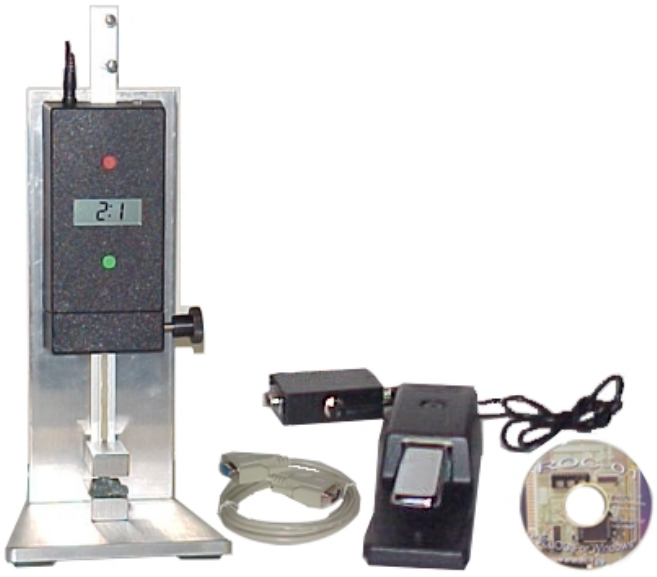

FIGURE 1. Digital Caliper

Project:	**Tester Name:**	
	Date Tested:	
	Aggregate Source - Type:	
	Dimensional Ratio Used:	

	A	**B**	**C**	**D**	**E**	**F**
Size Fractions (Passing by Retained)	**Cumulative Percentage Passing (%)**	**Individual Percentage Retained (%)**	**Weight of Sample (g)**	**Weight of Flat & Elongated Particles (g)**	**Percentage Flat & Elongated Particles** $\left(\frac{D}{C}\times 100\right)$	**Individual % Retained × % F&E Particles (B × E)**
3 in. × 2 in.						
2 in. × 1½ in.						
1½ in. × 1 in.						
1 in. × ¾ in.						
¾ in. × ½ in.						
½ in. × ⅜ in.						
⅜ in. × No. 4						
Total of Column B →			Total of Column F →			
			% Flat & Elongated Particles $= \frac{\text{Total F}}{\text{Total B}} =$ ——— $=$ ——— %			

Example Calculations

PERCENTAGE OF FLAT AND ELONGATED PARTICLES FOR COARSE AGGREGATE

Project: Example Calculations	**Tester Name:**	Tester A
	Date Tested:	04-10-09
	Aggregate Source – Type:	Rock Producers of America, CA - ¾" NMAS
	Dimensional Ratio Used:	5 : 1

	A	B	C	D	E	F
Size Fractions (Passing by Retained)	**Cumulative Percentage Passing (%)**	**Individual Percentage Retained (%)**	**Weight of Sample (g)**	**Weight of Flat & Elongated Particles (g)**	**Percentage Flat & Elongated Particles** $\left(\frac{D}{C}\times 100\right)$	**Individual % Retained × % F&E Particles (B × E)**
3 in. by 2 in.	100	0	- -	- -	- -	- -
2 in. by 1½ in.	100	0	- -	- -	- -	- -
1½ in. by 1 in.	100	0	- -	- -	- -	- -
1 in. by ¾ in.	96	100 – 96 = 4 (not used))	(not used)	- -	- -	- -
¾ in. by ½ in.	82	96 – 82 = 14	408.1	51.4	13	182
½ in. by ⅜ in.	64	82 – 64 = 18	202.4	15.9	8	144
⅜ in. by No. 4	52	64 – 52 = 12	77.6	5.2	7	84
Total of Column B →		14 + 18 + 12 = 44	Total of Column F →			410
			% Flat & Elongated Particles $= \frac{\text{Total F}}{\text{Total B}} = \frac{410}{44} = 9\ \%$			